Smart Library Management and Service Based on Wearable Technology

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Keywords: Smart Library, Wearable Technology, Wearables, Service and Management

Abstract: The intelligent library uses ecological theory to construct a knowledge resource ecosystem to provide users with better knowledge services. At the same time, it can promote knowledge circulation and innovation, reduce the cost of knowledge utilization, and improve the level of intelligent services. This paper introduces the ecosystem of library knowledge resources and its characteristics. This paper introduces the main functions of the university's knowledge resource ecosystem, and designs a knowledge resource ecosystem framework with specific functional modules. And established a corresponding operational guarantee mechanism. The wisdom of the library and the wisdom of information management are inseparable from technology and people. The design thinking co-ordinates the relationship between libraries, technology and people, and clearly grasps all the links in the construction of smart libraries. Design thinking makes the construction of smart libraries the technical application in the chapter is easy to use, and the future development trend of the library is examined from a new perspective. Reinterpreting smart libraries from three dimensions: wireless penetration, intelligent mobility and comprehensive sensibility. According to the "comprehensive perception" attribute of wearable technology, it is introduced into the research of intelligent library management and service. By building its infrastructure, to achieve the goal of building "five smart" smart library.

1. Introduction

In recent years, with the rapid development of information networks and smart technologies, libraries have long ceased to be the only channel for readers to acquire knowledge resources. This marginalized crisis has prompted libraries to accelerate their entry into the social network process, proactively approaching users, and doing everything they can to make new innovations based on existing services [1-4]. Until the concept of "smart earth" was proposed by IBM in 2009, the

wisdom library was widely concerned by domestic scholars. It also opened up theoretical research and practical exploration of intelligent libraries and intelligent library services. In today's rapidly changing digital world, libraries are being surrounded by emerging technologies, and user expectations are growing [5-7]. A large number of emerging technologies and cutting-edge technologies represented by MOOC, 3D printing, advanced multimedia, information visualization, wearable technology, machine learning, etc. have great application prospects in university libraries and public libraries [8]. Libraries should actively explore how these technologies can be integrated into their services, projects, and activities to make these technologies truly accessible to libraries, while also creating opportunities for users to engage with these cutting-edge technologies. Integrating these technologies into the services and work of the library not only innovates the way the library is served, but also expands the scope of services and improves the service level. It also allows users to feel the library's positive and open acceptance of emerging and cutting-edge technologies [9-11]. At present, there are not many successful smart library services through the Internet of Things, cloud computing and RFID. For example, the Yantian District Library in Shenzhen provides readers with a digital, integrated and intelligent wisdom platform. Beijing University of Posts and Telecommunications Library Experimental Wisdom Library.

Based on the initiative of sensing user data, the intelligent library makes full use of various intelligent technologies to realize intelligent management of various resources. Provide users with a ubiquitous intelligent service environment [12]. As a teaching and research place, university libraries, as an important institution for advanced technology research, are oriented to the diverse needs of users in the era of knowledge economy. It is also moving in the direction of the smart library [13-15]. The role of current knowledge resources is further highlighted. The development of social economy is inseparable from the creation of knowledge. Many industries are striving to create a reliable ecosystem of knowledge resources. As early as 1995, GeorgePor proposed the concept of knowledge ecology based on the article "seeking organizational intelligence" based on the understanding of natural ecosystems [16]. Since then, scholars from various countries have gradually made the knowledge resource ecosystem a research focus, trying to promote the effective integration of knowledge resources and technology, manpower and environment through the transformation of basic research and application results, and further highlight the application advantages of knowledge. The research on the knowledge ecosystem in the field of essays began in 2009, and it is still at the stage of exploration. While enriching the basic theory of library science, it reveals the library's resource operation law and knowledge service ecology to a certain extent [17-19]. The construction of the library's knowledge resource ecosystem is a complex process. Guided by the user's knowledge needs, it aims to maximize user satisfaction through knowledge value optimization [20]. In the era of rapid development of knowledge economy, in order to better provide guarantee for teaching and scientific research and comprehensively increase the number of national knowledge reserves, colleges and universities' intelligent libraries should conform to the needs of the knowledge economy era and build a reliable ecosystem of knowledge resources. Based on the knowledge network, provide users with smarter knowledge services. One of the most valuable potential outcomes of introducing wearable technology in the library industry is the ability to provide readers with more efficient, convenient, and personalized instant experiences and smart services. Achieve the 8 A goal of the library industry, that is, any service theme library can provide any period, any type, any format and information resources of any language to any user of the service object anytime, anywhere.

2. Wisdom Library Overview

The background proposed by the Wisdom Library: The idea of combining "wisdom" and "library" originated from the construction of smart networks and virtual communities by foreign researchers. In 2003, Finnish scholar Aittola published a book called "Smart Library: In the article on location-aware mobile library services, the concept of SmartLibrary was officially presented for the first time. The article believes that the smart library is a kind of Mobile services without space and time can be perceived by users at any time. This article marks the beginning of the intellectual library research, and there have not been many articles published in this regard. Until 2009, IBM proposed "smart planet" The concept has opened up people's continuous exploration of topics such as "smart city", "smart medical care" and "smart community." In order to comply with the trend of library development in the information age, the research of intelligent libraries has rapidly penetrated into people's field of vision. At present, intelligent libraries have become an inevitable trend in the development of libraries, both in theory and in practice.

The Connotation of the Wisdom Library: There is no unified definition of the connotation of the Wisdom Library, but as scholars continue to deepen their research, they have also summarized their views. In 2010, Yan Dong pointed out in his article "Internet of Things-based Knowledge Library" that intelligent libraries use next-generation information technologies, such as the Internet of Things and cloud computing, to change the way users and library information resources interact. Thereby, a new library model integrating intelligent service and management is realized. Subsequently, Wang Shiwei proposed that the intelligent library is a more advanced stage of the development of intelligent libraries. Based on the information technology dimension, the new library service model is centered around ubiquitous, convenient and spatio-temporal reader services. The focus is on the sustainable development of the library. Li Xianzhi, Chen Yuan, Zeng Ziming, etc. all believe that "providing readers with ubiquitous wisdom services" is the ultimate goal of the development of intelligent libraries, emphasizing the concept of people-oriented, service-oriented, and better realized by the promotion of modern intelligent technology. Collaborative innovation and development of the library. The author attributes the smart library to the inevitable stage of digital library development. Having IoT, cloud computing, RFID, data mining, personalized recommendation technology and smart devices for mobile devices means achieving the goal of connecting books, books and everyone. This will enable "appropriate knowledge to be delivered to the right people at the right time".

Characteristics of the Wisdom Library: As a new model for the future development of the library, Wang Shiwei summarizes the characteristics of the intelligent library from both internal and external aspects. Its external representation is digital, networked and intelligent, while interconnection, efficiency and convenience are its true intrinsic features. On the basis of this, Xie Fang, Qi Jiewang and Li Xiaotao further enriched the open, perception, synergy, personality and green energy conservation into new features of the smart library, which reflects that the intelligent library has gradually entered the user. In summary, the elaboration of the characteristics of the intelligent library can be derived from the two dimensions of philosophy and practice. The concept embodies the characteristics of people-oriented and sustainable development. In practice, it also reflects its unique four wisdoms: That is to say, the wisdom of resource acquisition, the wisdom of knowledge integration, the wisdom of user demand perception, and the wisdom of service model.

3. Definition and Type of Wearable Technology and Equipment

Wearable technology is a cutting-edge science technology that primarily explores and creates

wearable devices. A wearable device is a computing-based device that can be worn on a user, usually in the form of accessories, such as necklaces, glasses, backpacks, etc., or even real clothing such as shoes or jackets. Wearable form, independent computing power, dedicated application or function are its main features, and intelligent sensing technology, human-computer interaction technology and information processing technology are the three key technologies involved. The wearable device has a built-in independent computing chip that maintains the network connection status anytime and anywhere, and collects, recognizes and perceives the wearer's various behaviors, motion trajectories and situational information through its core components, various types of sensors, and is flexible with the wearer. The human-machine information interacts and can analyze and process the collected information and data. Compared with other smart devices, wearable devices emphasize the real-time data interaction and human-machine information interaction, and the ability to collect, sense and process information has been further improved. There are many kinds of wearable devices, and the typical products on the market mainly include smart bracelets, smart watches, smart glasses, sports cameras and the like. Google Glass, which was born in 2012, is not the earliest wearable device, but it is one of the most representative smart wearable devices, opening a door for wearable technology. In 2013, wearable technology first appeared in the New Media Alliance Horizon Report series, which reported that this technology will have a major impact on higher education in the next 4-5 years; in 2015, the New Media Alliance Horizon Report will again Wearable technology is one of the major advances in educational technology in higher education. Today, wearable technology is facing a good development opportunity, and its market expectations are more optimistic.

Wearable devices are mobile, people-oriented, hands-free, intelligent, sustainable work, human-computer interaction, wireless communication and so on. With its many forms and applications, the Vandrico Wearables database contains only 433 wearable devices. There are two types according to the form of appearance and the field of application. According to the appearance, wearable devices include hats, helmets, headbands, glasses, armbands, wristbands, watches, gloves, rings, headphones, headphones, belts, buttons, footwear, clothing, school bags, accessories, etc. such as GoogleGlass, iWatch Smart Watch, Sony Headset 3D Cinema, GolfSense Training Gloves, MTO Wristband, NikeFuelband Bracelet, NoPlaceLikeHome Satellite Navigation Shoes, Fujitsu "Smart Cane", Airwaves Mask, Vigo Alarm Tracker, Wearable Wireless 3D Human Body Tracking system. According to the application field, wearable devices can be divided into leisure entertainment, medical and industrial assistance, as shown in Figure 1.
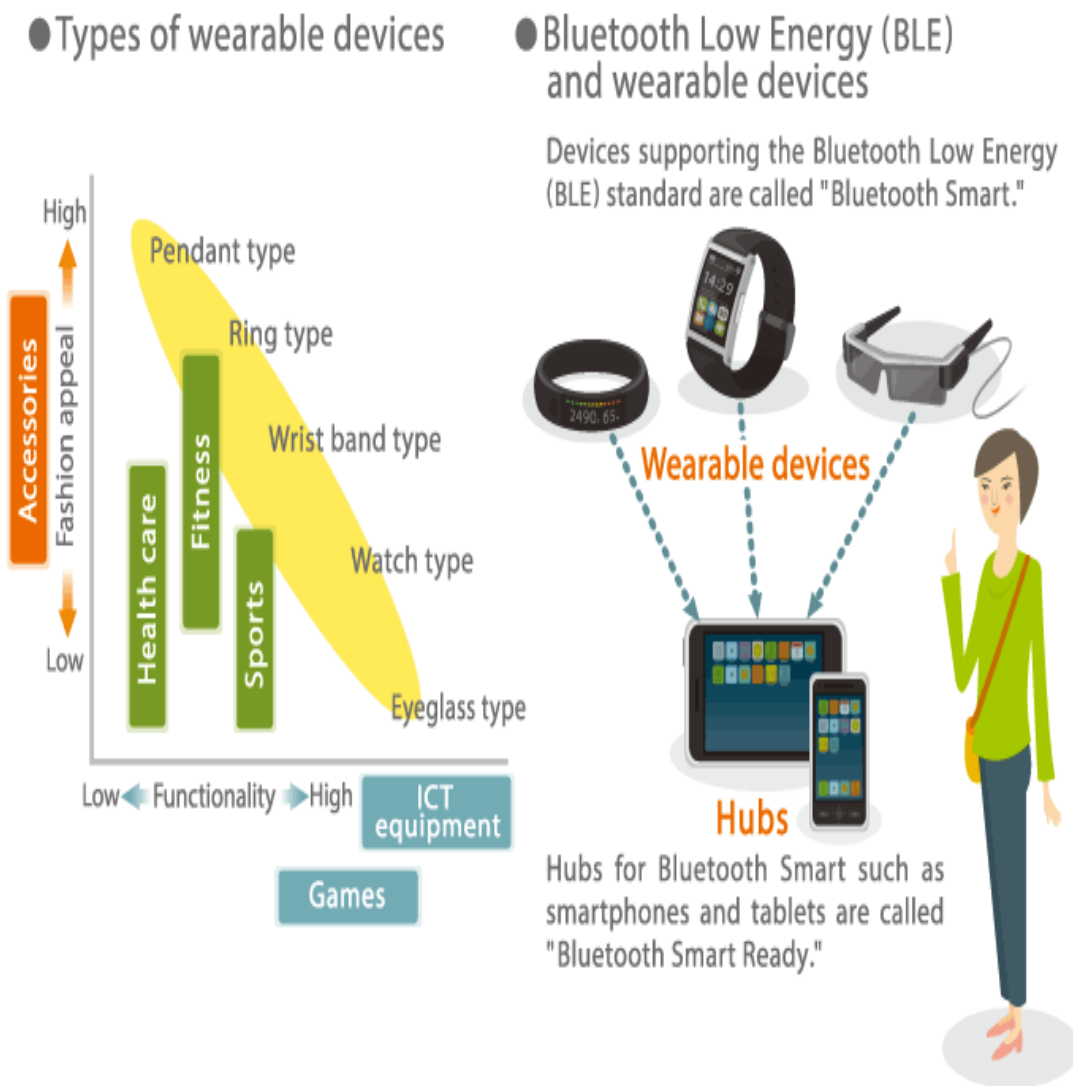
Figure 1. Wearable device type

Casual wearable devices utilize convenient portable features and integrated wireless networking capabilities for instant messaging, video chat, email and SMS, motion detection, map navigation, game capture and web payment applications. The wearable device is mainly used for medical monitoring and monitoring of blood glucose, heart, Parkinson's syndrome, lifestyle, so that the wearer access to their own physical condition, more timely and more accurate cure diseases, help to restore hearing and vision, As shown in Figure 2. Industrial auxiliary wearable device has important application value and broad application prospects in information technology assistance, operator training and performance support, environmental and equipment monitoring.
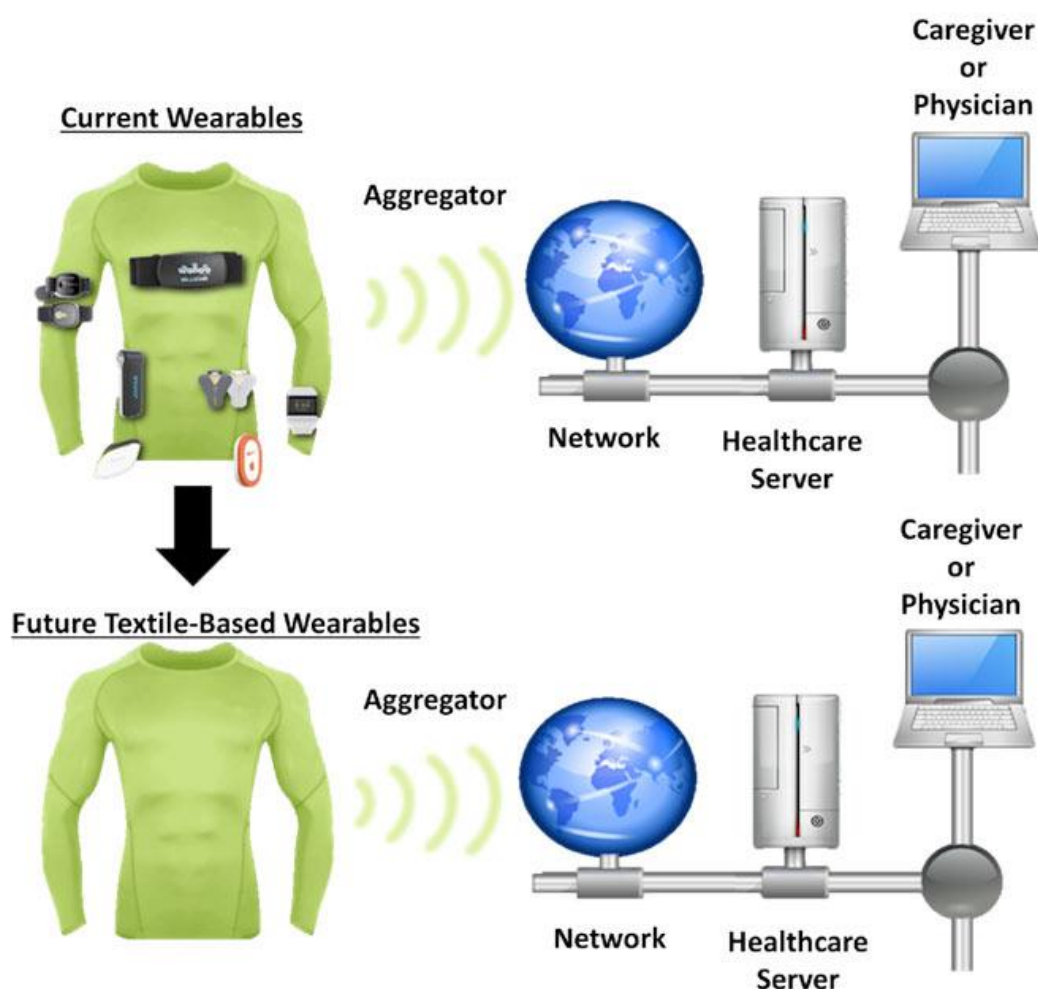
Figure 2. Wearable for health applications

4. Wisdom Library Research Content Based on Wearable Technology

4.1. Based Library Management and Service System Architecture Wisdom Wearable Technology

Intelligent library management and service research based on wearable technology needs to give full play to the "comprehensive perception" attribute and combine the three basic elements of the intelligent library. Utilize ubiquitous networking technologies such as the Internet of Things, cameras, RFID, wearables and sensors. Instantly identify, collect, monitor and manage all kinds of information within the library, such as buildings, environments, equipment, resources and people. And transform it into a data format suitable for network transmission, transmit it to the data processing center of the library through the network, and through the big data analysis technology, make people and people, things and things, people and things mutual perception and mutual communication, Realize the characteristics of "feeling, understanding, connecting, and controlling" of intelligent management and service. Construction of the library will create all the wisdom of readers and library staff work an intelligent management and service establishments in order to "understand you" and "get to know you." Form a ubiquitous learning atmosphere and

communication space, and give full play to the main role of library culture education.
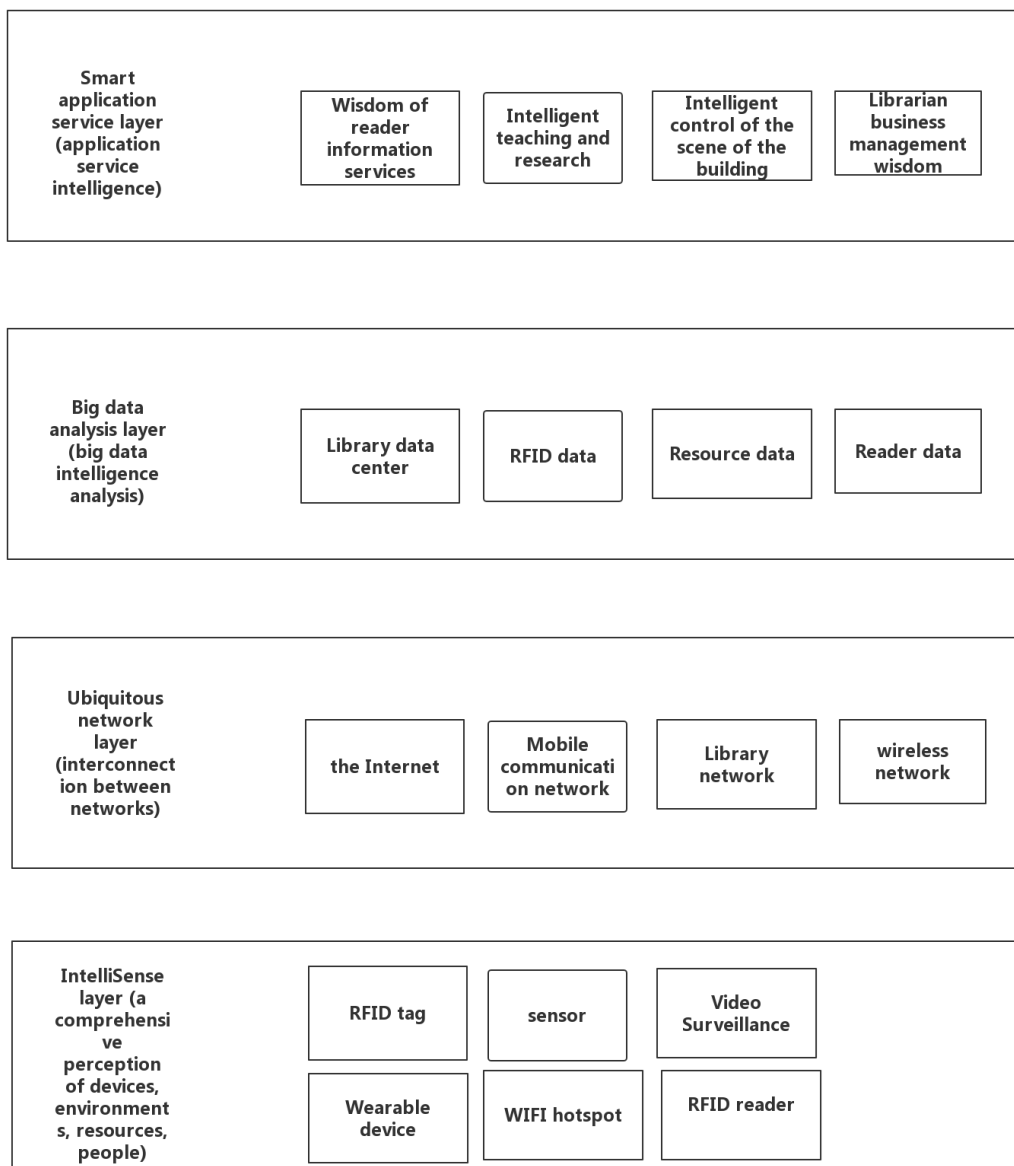

Figure 2. Smart library management and service architecture based on wearable technology

The intelligent library architecture based on wearable technology mainly includes: intelligent sensing layer, ubiquitous network layer, big data analysis layer and intelligent application service layer as shown in Figure 2. The intelligent sensing layer utilizes RFID readers, wearable devices and sensors to provide a comprehensive view of the library environment, resources, equipment and personnel. The data processing center a variety of information collected by the depth of excavation and intelligent analysis, and data transmission through the interconnection network. The intelligent application service layer will fully reflect the full range of intelligence of intelligent library management and services based on wearable technology.

4.2. Basic Function Module

1. Perform indoor intelligent positioning of the library

Indoor positioning based on wearable devices is based on the extension of indoor navigation positioning of mobile phones. By using iBeacon technology to deploy iBeacon devices indoors, people can also accurately position wearable devices indoors. Zhishi Technology, which provides indoor precision positioning service in China, combines the self-developed Bluetooth gateway CloudBeacon with a smart bracelet to construct a Beacon Bluetooth positioning system to view the geographical position of the wristband wearer at any time and to perform reverse tracking of its action track. , hot data collection, etc., and has been used in Shanghai Li Xiubao Children's Education Park. This application of Zhishi Technology is also the first case in China to apply indoor positioning technology to wearable devices. Similarly, the library can also use the wearable device to complete the indoor intelligent positioning, thereby implementing functions such as information push, destination navigation, and user assistance. Information push. When a user wears a wearable device to move around in the library, the library can sense the user's location in real time and provide intelligent notification of corresponding notifications, resources, and information based on the user's geographic location. Users can receive these push information on their own devices, such as when they enter the library, receive greetings sent by the library and recent lecture training activities; enter a reading room or come to the library When the subject is in front of the bookshelf, it receives the new book information of the area or the recommended information of the paper resources and electronic resources commonly used in the subject; when it comes to the self-service lending machine, it receives the self-service loan repayment process description of the push. and many more. Destination navigation. In addition to providing location-based information push services, the library also provides location-based navigation services for users using location and navigation technologies in wearable devices. By accurately locating the user's current location and then performing optimal path planning, the user is provided with precise navigation support for various locations and collections within the library. The location navigation function of the wearable device can quickly guide the user to the corresponding position in the library in a visual way, improve the efficiency of the user in finding resources, facilities and space, save a lot of time for the user, and provide emergency for the user in case of emergency Evacuation guidelines and location of fire protection equipment. User assistance. When the user encounters a problem in a certain position in the library, such as finding the required book on the shelf, the access control room cannot be opened, etc., when the librarian needs assistance, the librarian can send help information to the librarian. On-site guidance and assistance to the user by identifying the user's geographic location. In addition, librarians can receive notifications that if a user spends a lot of time in a particular area without moving, it may indicate that he/she needs help, which helps the librarian to proactively provide a specific location. On-site assistance from the user. In public libraries, wearable devices can also be used to safely monitor elderly, children or people with disabilities.

2. Collect and analyze user data so that the library can provide personalized information services. Intelligent sensor technology is one of the core technologies of wearable technology. A variety of sensors are built into the wearable device to easily capture large amounts of data and information from users. Through the carrying of the wearable device on the human body or clothing, it can detect the position, movement and behavior of the wearer, comprehensively perceive various physiological, emotional, cognitive, reading and other needs generated by the user, and collect the user's lifestyle and physical state in real time. , social habits, personal interests and other

characteristics of the data. In addition, in the library application, the wearable device can also record the user's reading history and information behavior, and instantly capture the user's action trajectory inside the library and the time spent in each area. These data collected through wearable devices provide the library with a comprehensive view of the user's personal information. Through cloud computing and big data processing, the library can improve the behavior of each user's library after statistical analysis and deep mining of collected user interests, reading needs, reading history, museum trajectory, stay area and time. And the understanding of the use of preferences, grasp the focus and hotspots of users' attention, and thus help to provide users with personalized resource recommendations and services efficiently and conveniently, and more intelligently meet the personalized information needs of users.

3. Integrate wearable devices into the tour reference service.

The roving reference is a way for librarians to provide reference services to users outside the fixed counseling desk. Librarians provide services to users by walking around the hall or visiting the venue outside the library. This type of service encourages librarians to proactively move toward users, while also helping to create a more intimate relationship between librarians and users. When conducting a tour reference service, librarians need to carry some of the more advanced equipment, such as a small laptop or tablet that can be connected to the network, to help users find resources and answer user questions. Wearable devices with similar functions are a better choice for libraries to carry out this service. Compared with laptops and tablets, librarians can also access library and Internet resources at any time by carrying wearable devices. Relevant information, but this can fully liberate the hands, make the librarians more convenient and flexible to carry out the service, and can attract the attention of the users, so that users have a strong interest in the service. In addition, the library's use of wearable devices in this visible way also enhances the public image of the library and helps to present a proficient and forward-looking corporate image to users or visitors.

4. Using the wearable camera to shoot the first perspective teaching video.

In order to more intuitive and clear to the user to present the relevant content of the library use guidance, the library can record the hands-on teaching video for the user from the creator's point of view, and will shoot The first perspective instructional video is added to the usage guide. The library uses the GoPro motion camera, Google Glass and other wearable devices to create a first-view instructional video for users to help users make better use of the library. One of the simplest first-view instructional videos is to show users how to find a book in the library. In the video, the device wearer can record the relevant information of a book from the time of entering the library and entering the book before the bibliographic inquiry machine, write the book number and the collection area of the book, and then enter the corresponding area in the book library. Finally, the process of finding this book. Similarly, the library can also take a first-view video tutorial that uses a self-service borrower to complete a book loan operation. These captured videos need to be uploaded to the library website for more users to watch, and at the same time in the library, such as the self-service borrower to post the QR code corresponding to the video tutorial, when the user needs to use it on site. When you help, you can use your mobile phone or wearable device to scan the QR code directly, open these videos and watch them.

5. Goals Based on the Wisdom of the Library of Wearable Technology

The intelligent library construction based on wearable technology is through the interconnection of building, equipment, network, resources, librarians, readers and other elements in the library, forming the resource wisdom, intelligent teaching and research wisdom and environmental wisdom

of the Internet of Things library. American wisdom, management wisdom, and service intelligence. The five intelligent technologies complement each other, interdependent, interact and coordinate with each other, forming a new situation of the intelligent management and service model of the "five-in-one" intelligent library. (1) Resource wisdom. Integrate library digital resources and collect physical resources in depth, realize metadata warehousing integration of all site resources, and realize functions such as total station retrieval, resource unified classification and navigation, resource subscription, and resource intelligent push. When the wearable device discovers the information request or instruction of the card reader, the system background will quickly explore and analyze the reading history, behavior track, browsing time and other related data of the card reader to provide location-based resource subscription and intelligence for the card reader. Push. service. (2) Teaching and research wisdom. The close combination of wearable devices and teaching classrooms has four advantages: First, the whole process can be filmed and recorded during the course. The problems and difficulties in the course can be uploaded to the cloud server at any time, and then analyzed and processed by the cloud server. Get timely and accurate data. Feedback to the reader's desired answer. Second, the wearable device can monitor the health indicators such as the student's heart rate and respiratory rate at any time, so that the teacher can grasp the physical condition of the student in time, conduct physical training or respond to various emergencies. Thirdly, wearable devices post-evaluate and track the teaching effects of each subject through visual methods, and objectively judge the advantages and disadvantages of each subject to achieve the effect of intelligent evaluation of teaching effects and intelligent guidance of teaching decision-making. Fourth, when conducting subject services, wearable devices can immediately receive academic results and dynamic information related to the subject, so that readers can timely understand the research progress of the subject and realize the functions of promoting subject services and intelligent assistant research. (3) Environmental information. Environmental intelligence is mainly reflected in the unified monitoring of various facilities and scenes such as lighting, air conditioning, lockers, cameras, seats, parking spaces in the library building, by embedding sensor devices on each device. Create a sensible learning atmosphere and smart space for readers. (4) Management wisdom. A smart library based on wearable technology will revolutionize the management structure and management model of the library. On the one hand, the construction of the three-dimensional scene of the library can obtain the information of the readers and the library area in the library in real time, and realize the dynamic monitoring of the overall environment of the library; on the other hand, the books are automatically completed and statistically read by RFID; writing equipment To make librarians' daily business work more automated and standardized. At the same time, the use of wearable technology and holographic projection technology effectively combine to promote library management work more convenient and intelligent. (5) Service wisdom. Service wisdom is mainly reflected in the library will become a service center of "know you" and "know you". On the one hand, the wearable device can superimpose the library space function information of the library entity building with the virtual layer to realize the collection; and guide the reader to quickly find the collection place by means of the precise intelligent navigation function of the exhibition. That is to say, when the reader wears wearable devices such as Google Glass or AppleWatch in the reading room, the reading room will actively greet the reader; for the books that the reader needs, the system can quickly locate the position of the bookshelf and guide the reader through visualization. The automatic translation of foreign language books, the 3D version of paper books, and the voice explanations of sports exhibition activities are also characteristics of wearable devices. On the other hand, augmented reality, voice control and environmental scanning of wearable devices can provide intelligent

services to vulnerable groups such as the elderly, children and the disabled. For example, the "finger reader" of the Massachusetts Institute of Technology Media Lab allows readers with impaired vision to read aloud and so on. Finally, the statistical results of the questionnaire survey through satisfaction are shown in Figure 4 below. It can be seen that more than 90% of the users expressed their recognition for smart library management and services based on wearable technology.
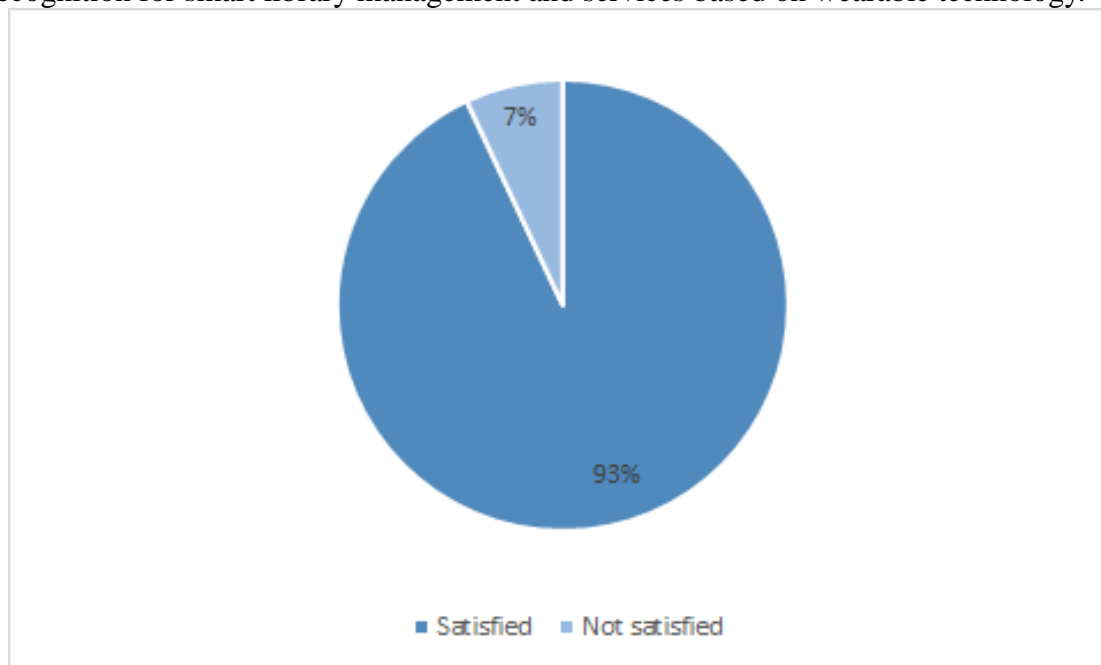

Figure 4. Smart library management and service satisfaction statistics based on wearable technology

6. Conclusion

Wearable technology, as a frontier science and technology with great development potential, has a good application prospect in the field of libraries. Abroad, mainly in the United States, many libraries, including university libraries and public libraries, have taken the birth of Google glasses as an opportunity to gradually introduce wearable technology and wearable devices into their own libraries. For domestic libraries, on the basis of actively summarizing relevant foreign experience, combined with the actual situation in China, we can deeply explore the value, feasibility and action of introducing emerging technologies and cutting-edge technologies such as wearable technology in domestic libraries, constantly optimize library services. Based on the research and management of smart library management and service based on wearable technology, it aims to build a scientific, human and intelligent library management and service model, change the way of information exchange and channels between readers and libraries in the traditional sense, and give full play to the subjective action of readers. To enable readers to respond to personalized information needs in a timely manner and intelligently push, the library will become a smart learning environment and space that "know you" and "know you", which can not only give readers a richer and smarter service experience, but also optimize books. Library reader service work and efficiency. The author's research will provide new ideas and concepts for the library community to open intelligent management and services, and the wisdom education industry will enter a new era.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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